

### Conclusions:

The use of a dietary protocol with IGRT can limit late rectal adverse effects. The mathematical model of AR, analyzed by using NTCP, turned out as the best predictor of the rectal late toxicity.

### EP-1267

#### Dosimetric impact of tumor and lymph node motion and anatomical changes in radiotherapy of NSCLC

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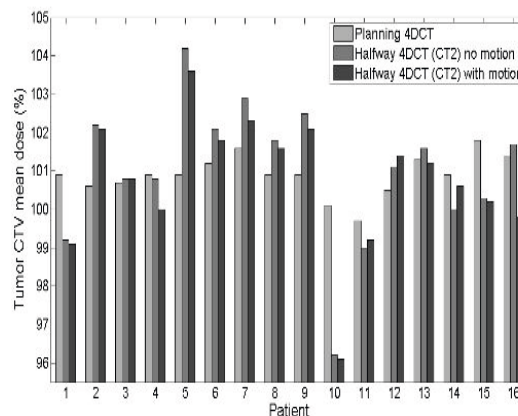
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**Purpose/Objective:** Patients with non-small cell lung cancer (NSCLC) have poor survival rates that may be improved by dose escalation. It requires margin reduction in order to keep the toxicity at an acceptable level. The purpose of this study was to investigate (1) the dosimetric impact of both target motion and anatomical changes during radiotherapy of NSCLC and (2) the possibility of margin reduction.

**Materials and Methods:** 16 NSCLC patients received intensity modulated radiotherapy (IMRT) with concomitant chemotherapy. The tumor and lymph node targets were delineated in the mid-ventilation phase of a planning 4DCT scan. The planning target volume (PTV) was formed from the clinical target volume (CTV) by adding margins of 10mm in the axial plane and 13mm in the cranio-caudal (CC) directions. Typically, 66Gy was delivered in 33 fractions using daily cone-beam CT with bony anatomy match for patient setup. A second 4DCT scan (CT2) was acquired halfway through the treatment and used to investigate dosimetric impact of target motion and anatomical changes. The tumor and lymph node targets were delineated in CT2 and the motion of both targets was extracted as a measure for the intrafraction motion. Rigid bone registration was used to transfer the original plan to CT2 thus mimicking the patient setup procedure. The plan was recalculated on CT2 with and without inclusion of the intrafraction target motion and the resulting CTV doses were compared with the planned CTV dose to investigate the dosimetric impact of both respiratory motion and anatomical changes. To investigate the potential for margin reduction a set of treatment plans were made on the planning 4DCT scan with 5mm isotropic CTV-PTV margins. The same procedure i.e. dose reconstruction in CT2 with and without inclusion of intrafraction motion, was performed for these treatment plans.

**Results:** Tumor and lymph node intrafraction motion was largest in the CC direction (1 - 11mm). The interfraction tumor shift relative to bones from the planning CT to CT2 was 0 - 10mm in all three directions. The figure compares the mean tumor CTV dose in CT2 (with and without intrafraction motion) with the planned mean dose for each patient. For most patients, the changes in the CTV dose were caused by anatomical changes (atelectasis, pleural effusion and pneumonia) rather than target motion. The margin reduced treatment plans had similar CTV doses as the clinical plans and they showed also greater dosimetric impact of anatomical changes than of tumor motion.



**Conclusions:** The anatomical changes had larger impact on the target dose distribution than internal target motion. The treatment plans with reduced margins had similar target dose coverage as the clinically applied plans, which indicate that the margins may be reduced. Large anatomical changes cannot be accounted for by increased margins, so in order to achieve better target coverage throughout the treatment, adaptive radiotherapy could be used.

### EP-1268

#### An assessment of the Elekta Fraxion immobilisation system for image guided stereotactic radiosurgery

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**Purpose/Objective:** Stereotactic Radiosurgery (SRS) is a specialised technique designed to focus high doses of ionising radiation on a tumour (malignant or benign) in a single fraction which spares normal tissue. Accuracy of setup is paramount to ensure correct dose delivery, and to potentially reduce treatment margins. The Elekta Fraxion® immobilisation system comprises a head frame, vacuum occipital cushions and an optional vacuum positioned mouth bite to produce a reproducible patient immobilisation system. The setup accuracy and precision of the immobilisation system was assessed. This was performed using Cone Beam CT (CBCT) to assess initial setup, positioning after online imaging, and intra-fraction motion.

**Materials and Methods:** Patients were initially immobilised at CT using Fraxion. An appropriately sized headrest was selected for the patient. The patient was scanned and the images exported to Pinnacle. An isocentre was identified in Pinnacle and this exported to Ergo for localisation and transfer to a localiser box. Patients were setup for SRS using the localiser box, and imaged with CBCT before treatment. An online correction protocol was used, with a tolerance of 1mm. Where possible, patients were imaged post-treatment to enable an assessment of intra-fraction motion to be made. Patient setup errors from CBCT were used to assess the accuracy of patient setup, between CT and SRS. This accuracy is influenced by factors such as laser setup, localisation accuracy, patient setup in the shell and CBCT system accuracy.

**Results:** An initial cohort of 25 patients was analysed. On imaging, 20% were within the 1mm tolerance in all directions, and did not require moves. The remaining patients required moves in one or more directions, typically of less than 2mm, and were re-imaging before treatment. A population setup error was calculated of 1.9mm for the uncorrected images. The patient cohorts' images show some skew in initial setup position. A systematic shift in the height of 0.9mm was seen, which will be fed back to influence laser setup and localisation. The online correction protocol was followed and a population systematic error of 0.8mm for the corrected images was seen. This error will comprise of elements such as accuracy of bed moves. Intra-fraction motion data was used to calculate a population random error of 0.3mm. This error will comprise of patient motion elements and reproducibility of the CBCT system.

**Conclusions:** Utilising CBCT, an online imaging protocol has enabled the identification of small systematic errors in initial patient setup in SRS. This data is being used to influence future patients' setup. After correction using couch moves, a population systematic error of 0.8mm and a random error of 0.3mm were observed. This is within the specification laid out for stereotactic treatment at the centre. This data will be fed back into margins used in treatment planning.